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## THE COMPETENCIES, TEACHING, LEARNING OPPORTUNITIES AND ASSESSMENTS FOR TRAINING IN PAEDIATRIC INTENSIVE CARE MEDICINE

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### 1. INTRODUCTION

Training is a process of integrating knowledge, skills and attitudes into safe and effective practice, which continues as lifelong learning and continuous professional development (CPD) over a specialist's career. The trainee becomes a lifelong learner, focused on patient care and activities which support patient care.

This document defines the competencies that a trainee should acquire during the training period, and subsequently maintain and enhance throughout their professional life. It lists how the competencies may be taught, learnt and assessed in training. It is a statement of the minimum level of competency expected on entering core training and at the end of training. It therefore covers the topics that will be assessed by In-Training Evaluation Reports (ITER), Workplace-Based Assessments (WBA), courses, Observed Clinical Encounters (OCE) and the First and Second Part Examinations in Intensive Care.

The domains covered are based on the Canadian Medical Education Directives for Specialists (or CanMEDS) framework, by permission, and further reading resources for the framework may be found at:

<http://www.royalcollege.ca/public/resources/aboutcanmeds>

*The CICM **novice trainee** is a trainee who, after the foundation term in intensive care medicine, has passed the First Part Examination, learnt the basic skills of intensive care medicine and is about to assume increasing responsibility for patient care over the ensuing years of core intensive care training.*

*The CICM **expert trainee** is a trainee about to move into independent practice as an intensive care specialist. The expert trainee is embarking on a career in which knowledge, skills and personal attributes will continue to develop and mature.*

Within each competency, it is understood that the trainee:

- a) acquires knowledge
- b) learns how to apply the knowledge
- c) shows how an action is performed, in the light of the applied knowledge
- d) undertakes the competency in clinical practice.

At each step the trainee is expected to acquire the necessary skills and attributes to function as an effective trainee in the following twelve months. This is to ensure that effective use is made of each year of training time.

## **Basic terms used in this document are:**

### **Key Competency**

A Key Competency is a broad statement of skills to be acquired by the trainee. Perusal of these alone will present the general picture of the objectives of training.

### **Enabling Competencies**

These are specific behavioural objectives. They are more detailed competencies that are essential for the Key Competency to be achieved. The development of additional competencies is encouraged.

### **Teaching, Learning Opportunities**

There are differing theories as to how each person learns and many different styles of learning are recognised. This document sets a framework and targets, which the learner and teacher can adapt to the individual learner's needs and style.

Teaching and learning within the specialist training model is based on:

- self-directed personal study
- hospital-based tutorials
- experiential learning in intensive care, hospital wards, emergency departments and operating theatres
- role modelling.

Therefore, in each section of this document it should be assumed that each of these learning opportunities would provide the basis of knowledge and skill acquisition. Nevertheless, the apprenticeship model requires supplementation with other learning opportunities:

- courses
- low fidelity simulation in workplace
- high fidelity simulation
- online learning packages, books and DVDs.

### **Assessment**

Assessment is an integral part of the continuous process of development, both formative and summative. Assessment should continue into the career of a specialist in the form of appraisal, reflection, self-assessment and re-accreditation. Assessment is a key component to being a lifelong learner, focused on patient care and the activities which support that care. The basis of assessment in training will be:

- In-Training Evaluation Report (ITER) by Supervisors and other specialists
- Workplace-Based Assessment (WBA) by Supervisors and other specialists

Therefore, in each section of this document, it should be assumed that each of the competencies would be assessed by ITERs and WBA, directly or indirectly. Nevertheless, the apprenticeship model requires additional assessments be performed to ensure that all competencies are covered in a criterion-referenced, relevant, transparent, reliable, valid and fair manner, incorporating feedback and encouraging learning using specific formats, such as:

- formal centralised examinations

- pre- and post-tests within courses
- tests associated with low fidelity simulations in the workplace
- tests with high fidelity simulations
- Mini Clinical Exams (MiniCEX)
- pre- and post-tests with online learning packages.

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## **1. MEDICAL (CLINICAL) EXPERT**

### **1.1 BASIC SCIENCES FOUNDATION**

This section should be read in conjunction with the syllabus for the First Part Examination.

#### **1.1.1 Introduction**

The novice trainee acquires a broad understanding of physiology, pharmacology, anatomy, evidence-based medicine and clinical measurement, as is applicable to intensive care practice. These sciences provide a sound basis for learning and clinical practice.

#### **1.1.2 Evidence-Based Medicine (EBM)**

##### ***Key Competency***

The novice trainee understands the scientific method, its application in research and describes the principles of EBM. The expert trainee uses those principles in performing or critically evaluating published research and reviewing evidence.

##### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe EBM and the principles of original research, a systematic review and a meta-analysis
- b. describe the stages in the design and conduct of a clinical trial
- c. describe commonly used statistical principles
- d. describe error and bias and their effect on evidence quality
- e. explain the ability of a test to predict the presence or absence of a disease
- f. explain risk estimation and tests of significance.

*The expert trainee is able to also:*

- a. critically appraise published original research, and demonstrate the strengths and limitations of systematic review and meta-analysis when assessing evidence for clinical practice
- b. use the stages of the design and conduct of a clinical trial
- c. use common simple statistical principles
- d. assess error and bias and their effect on evidence quality derived from experimental and non-experimental trial designs
- e. assess the ability of a test to predict the presence or absence of a disease
- f. use risk estimation and tests of significance.

#### **1.1.3 General Pharmacology**

##### ***Key Competency***

The trainee describes the principles of general pharmacology, as they are applicable to the safe practice of intensive care medicine

### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe how drugs are formulated and presented (pharmaceutics)
- b. describe how the body handles drugs in normal and disease states (pharmacokinetics)
- c. describe how drugs affect the patient (pharmacodynamics) in therapeutic dose, in disease states and overdose.

*The expert trainee is able to also:*

apply knowledge of pharmacology principles to the use of a broad range of medications in varied clinical settings in children with organ failure.

## **1.1.4 Procedural Anatomy, Applied Physiology and System-Based Pharmacology**

### **Key Competency**

The trainee describes the principles of physiology, anatomy and pharmacology applied to each body system, as they are applicable to intensive care medicine, including how they are affected by disease state and common intensive care treatments.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. explain basic cellular physiology
- b. describe applied physiology, procedural anatomy and clinical pharmacology in normal humans and the critically, related to:
  - i. the cardiovascular system
  - ii. the respiratory system
  - iii. the autonomic system
  - iv. the renal system
  - v. the musculoskeletal system
  - vi. the body fluids, and electrolytes
  - vii. the nervous system
  - viii. the haematological system, including immunology
  - ix. metabolism and nutrition, the endocrine system and thermoregulation
  - x. maternal, foetal and neonatal medicine.

*The expert trainee is able to also:*

- a. apply knowledge of anatomy and physiology to the use of a broad range of treatments
- b. demonstrate an understanding of disease pathophysiology in varied clinical settings and in children with organ failure.

## **1.1.4 Principles of Measurement and Clinical Monitoring**

See the syllabus for the First Part Examination.

**Key Competency**

The trainee is able to safely use and explain the principles of monitoring and clinical measurement relevant to intensive care medicine.

**Enabling Competencies**

*The novice trainee is able to:*

- a. explain the general mathematical and physical principles on which common ICU monitoring is based
- b. explain the specific techniques used in a wide range of devices
- c. explain the principles underlying errors, limitations and difficulties in interpretation.

*The expert trainee is able to also:*

- a. apply knowledge of clinical measurement to the use of a broad range of techniques
- b. Demonstrate an understanding of use in varied clinical settings and in children with organ failure.



## 1.2 MANAGEMENT OF THE CRITICALLY ILL AND INJURED CHILD

### INTRODUCTION

The paediatric intensive care specialist is required to manage critical illness from the neonatal period to beyond adolescence. The trainee must be familiar with age-related immunologic and physiologic vulnerabilities, and how these influence the manifestation of life-threatening conditions. A broad experience in the diagnosis and management of the acute and chronic conditions of childhood is essential. The paediatric critical care practitioner will advocate for preventative health and child protection programs.

### ***Key competency***

The trainee will demonstrate expertise in the history, examination, investigation and treatment of the common illnesses of children and young people.

### ***Enabling Competencies***

*The expert trainee is able to:*

- a. describe how developmental and behavioural responses to illness influence the clinical presentation of disease
- b. demonstrate effective use of age-appropriate diagnostic testing
- c. demonstrate skill in the performance of simple interventions e.g. IV insertion, lumbar puncture
- d. demonstrate an understanding of the child's role in assent and/or consent to interventions
- e. demonstrate effective strategies to detect and manage the deteriorating child
- f. demonstrate an understanding of the role of the paediatric intensive care specialist in child protection.

## 1.2.1 THE APPROACH TO ACUTE ILLNESS

### INTRODUCTION

Management of acute illness is the cornerstone of the intensive care specialist's work. A safe and comprehensive approach is essential. This requires an understanding of how normal physiology may be disrupted by disease and a broad knowledge of medical and surgical conditions. It also requires mastery of procedural skills, priority setting, diagnostic skills and longitudinal care, all of which must be exercised whilst supervising junior doctors.

### Immediate Assessment and Therapy (Resuscitation)

#### **Key Competency**

The novice trainee is developing the ability to perform a rapid and accurate assessment of life-threatening problems in a critically ill child and helps to apply life-supporting therapy.

The expert trainee anticipates clinical problems. He/she is able to assess and define clinical problems in the critically ill in the broader context, and develops and facilitates a diagnostic and management plan appropriate to the likely and differential diagnoses. The expert trainee is able to make a timely, structured and accurate assessment of a comprehensive range of life-threatening problems in a critically ill child, apply life-supporting therapy and supervise junior doctors in the provision of safe care.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. Judge the priorities of immediate resuscitation
- b. Undertake emergency management, including basic and advanced life support
- c. Obtain relevant information rapidly and accurately, and perform a brief, pertinent examination to enable immediate and effective resuscitation, including the management of rapidly reversible problems
- d. Instigate emergency investigations during the course of resuscitation to exclude other rapidly reversible problems
- e. Obtain an accurate history (if this was not possible previously) and perform a clinical examination as soon as possible to detect the primary disease process
- f. Monitor physiological functions whilst further assessment is undertaken
- g. Recognise, and respond rapidly to, adverse trends in monitored parameters.

*The expert trainee is able to also:*

- a. Triage patients appropriately, including facilitating timely admission to ICU
- b. Differentiate patients who are likely to benefit from resuscitation from those who are not
- c. Assess the priorities of immediate resuscitation versus diagnosis and treatment of the primary disease process
- d. Undertake emergency management, including management of the difficult airway and difficult vascular access.

## **POST-RESUSCITATION CARE**

### **Formal Medical Assessment, Problem-Solving and Decision-Making**

#### ***Key Competency***

Following resuscitation, the novice trainee effectively contributes to the continuing management of the acutely ill child, and the expert trainee effectively leads and undertakes the continuing management of the acutely ill child.

#### ***Enabling Competencies***

#### **Assessment**

*The novice trainee is able to:*

- a. obtain relevant information from the child, relatives and other informed sources
- b. take and record an accurate and thorough medical history (with relevant family, past, and social history, including birth, developmental and immunization history)
- c. perform an appropriate physical examination
- d. assist in the diagnosis of a system failure, a disease, a pathological process, a clinical syndrome or a complication of therapy
- e. order appropriate initial investigations and interpret the results correctly to assist diagnosis, monitoring and assessment of therapy.

*The expert trainee is able to also:*

- a. ensure a comprehensive physical examination is performed and a complete history is documented
- b. recognise and diagnose a system failure, a disease, a pathological process, a clinical syndrome or a complication of therapy,
- c. develop a reasonable differential diagnosis which allows a rational management plan.
- d. order appropriate initial investigations and interpret the results correctly to assist in diagnosis, monitoring and assessment of therapy
- e. use metacognitive strategies in settings of complexity and uncertainty.

### **Problem Definition**

*The novice trainee is able to:*

- a. document patient information, either in a chronological, system or problem oriented format, allowing a clear presentation of the problems and progress
- b. generate an appropriate list of differential diagnoses, and prioritise investigations.

*The expert trainee is able to:*

- a. initiate a management plan, despite the ambiguity and uncertainty that absence of a definitive diagnosis may create
- b. establish a probable diagnosis and list of differential diagnoses.
- c. redefine the patient's problems in the light of these choices, while remaining alert to the possible presence of less likely diagnoses that may have life-threatening consequences
- d. analyse new information as it becomes available and continually review diagnostic probabilities and management plan.

### **Solution Generation and Decision-Making**

*The novice trainee is able to:*

- a. assemble facts and logically compare potential solutions to the patient's problems
- b. suggest a course or courses of action.

*The expert trainee is able to also:*

- a. assign weights and priorities to the patient's problems, and initiate a course or courses of action
- b. decide if there are elements of the patient's problem that are not dealt with by the selected course of action, and develop appropriate solutions for those elements.

### **Planning**

*The novice trainee is able to:*

- a. suggest a therapeutic plan, which incorporates the selected courses of action
- b. take note of potential interactions of elements of the plan

*The expert trainee is able to also:*

- a. institute a therapeutic plan that incorporates the selected courses of action, and takes note of potential interactions of elements of the plan
- b. plan counter-measures to potential complications of the disease or therapy
- c. consider risk/benefit and cost/benefit ratios of therapeutic alternatives in developing a plan
- d. consider whether treatment limitation may be or may become appropriate, and initiate appropriate discussions with treating teams and parents and/or carers with appropriate timing and sensitivity.

## **Progress**

*The novice trainee is able to:*

understand the requirement to assess the patient's progress, and to modify diagnosis and therapy when necessary.

*The expert trainee is able to also:*

- a. assess the patient's progress often, and modify diagnosis and therapy when necessary
- b. determine criteria for discharge from the PICU, and discharge the patient in a timely and safe fashion, with communication of a plan and issues to patient, family and receiving team as appropriate.
- c. assess the value of intensive care by follow-up after discharge
- d. counsel patients and families.

## **Consultation and Collaboration**

*The novice trainee is able to:*

- a. explain that consultation and collaboration play a vital role in the management of the critically ill child
- b. recognise his/her limitations in providing optimal patient care
- c. know how, when and whom to ask for assistance
- d. organise consultations effectively.

*The expert trainee is able to also:*

- a. effectively use multidisciplinary input (e.g. from physiotherapist, social worker, pharmacist, indigenous liaison officer).
- b. explain how, when and whom to ask for a second opinion, and appropriately incorporate the advice into management
- c. recognise his/her limitations in providing advice to other specialists
- e. keep specialists to whom the patient has been referred informed of progress, and encourage their participation in decision-making.

## **Assessment of Illness and Injury Severity and Outcome Prediction**

*The novice trainee is able to:*

- a. explain that there are clinical and physiological markers used to assess illness, and injury severity and scoring systems developed to predict the likely outcome from acute illness
- b. explain that sudden gross changes in certain physiological parameters are life-threatening (e.g. mean arterial pressure, pH, PaO<sub>2</sub>, plasma potassium concentration)
- c. assist in the accurate assessment and documentation of various scoring systems (e.g. Glasgow Coma Scale, Paediatric Index of Mortality (PIM), Paediatric Risk of Mortality (PRISM), organ system failure scores, injury severity scores).

*The expert trainee is able to also:*

- a. Appreciate when clinical severity of illness and organ dysfunctions or failure are an immediate threat to life
- b. Explain the strengths and limitations of scoring systems, mortality predication models and quality indicators
- c. Use clinical and physiological markers to assess illness and injury severity and uses the scoring systems for assessing the likely outcome from acute illness

## 1.2.2 PRINCIPLES OF ORGAN SYSTEM FAILURE MANAGEMENT

### INTRODUCTION

Patients with single or multiple systems organ failure (MSOF) form a major part of the workload of a PICU, and providing safe care of these patients is an essential skill for specialists. System(s) failure may be precipitated by a local cause or disease process, or be related to a systemic disease or process. Failure of one system may adversely affect the function of other systems, although in most cases of multiple systems failure, there is an underlying systemic cause (e.g. an uncontrolled generalised inflammatory response secondary to sepsis or other insult).

### Management of System(s) Failure

#### **Key Competency**

The novice trainee assists in safely managing a patient with a single or multiple systems failure and the expert trainee manages patients with single or multiple systems failure.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. recognise a specific organ failure, and assess its severity
- b. describe the underlying causes of system(s) failure and the importance of preventing and treating these quickly and definitively

*The expert trainee is able to also:*

- a. provide optimal treatment for any type of system failure
- b. adopt a balanced approach to the patient with multiple system failure; the aggressive management of one system should not be to the detriment of other systems, unless this course of action is necessary for the immediate survival of the patient
- c. describe commonly used definitions of organ failure and scoring systems based on these
- d. describe current concepts of the pathophysiological pathways and mechanisms involved and the evidence for and against interruption of such pathways as a means of treatment
- e. explain the prognostic implications of multiple systems failure or multiple organ dysfunction syndrome.

**Examples include, but are not restricted to:**

#### **(i) Acute Circulatory Failure**

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. define and recognise shock and assess its severity
- b. list the causes of shock and how they are identified and treated
- c. explain the steps involved in reversing shock, according to its aetiology and in response to haemodynamic and other physiological data
- d. explain the importance and limitations of non-invasive and invasive monitoring in the management of such patients.

*The expert trainee is able to also:*

- a. describe current concepts of the pathogenesis of shock and potential therapies
- b. explain the sequelae of shock, and therapeutic strategies relevant to their prevention and management
- c. explain the principles of outcome prediction in shock states
- d. manage the shocked patient, with appropriate use of fluids, vasoactive drugs and other support modalities.

## **(ii) Respiratory Failure**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. define and recognise respiratory failure
- b. describe the causes of respiratory failure and how these may be prevented or managed
- c. explain the principles of oxygen therapy.

*The expert trainee is able to also:*

- a. distinguish acute from chronic respiratory failure, and explain the implications for management
- b. diagnose the cause of respiratory failure, and explain the concepts of pathogenesis
- c. explain the role of investigations in the diagnosis of respiratory failure, including pulmonary function tests, bronchoalveolar lavage and open lung biopsy
- d. explain the potential for interruption of inflammatory mediator and other pathways as methods of treatment
- e. use oxygen therapy, mechanical methods of ventilatory support (invasive and non-invasive) and techniques to secure the airway
- f. recognise and manage the sequelae of respiratory failure on other organ systems
- g. demonstrate an understanding of the indications for extracorporeal support of gas exchange
- h. explain the principles of outcome prediction in patients with respiratory failure.

## **(iii) Acute Kidney Injury (AKI)**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. define and recognise acute kidney injury (AKI) and chronic renal failure (CRF)
- b. describe the causes of AKI and CRF
- c. explain how AKI may be diagnosed and managed.

*The expert trainee is able to also:*

- a. identify patients at risk of developing AKI, know the therapies that offer renal protection, and explain the indications for their use
- b. describe concepts of the pathogenic mechanisms leading to AKI
- c. explain the role of urinary analysis, biomarkers, ultrasound and renal biopsy in the diagnosis of the cause of AKI
- d. list the complications of AKI and its treatment, and propose a plan for prevention or management of these complications
- e. describe and prescribe the various forms of renal replacement therapy, describe their indications and applications, and use them effectively

- f. explain the principles of outcome prediction in patients with AKI.

**(iv) Neurological Failure**

***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the factors affecting cerebral blood flow and intracranial pressure
- b. define, recognise and list the causes of acute neurological failure, including coma, confusion, delirium and acute weakness
- c. explain how coma, confusion, delirium and acute weakness are managed
- d. define and recognise coma, and assess its severity.

*The expert trainee is able to also:*

- a. describe the appropriate assessment and investigation of an unconscious patient
- b. describe the indications for immediate neurosurgical consultation
- c. explain the indications for urgent neuro-imaging, and the requirements for safe performance of the procedure
- d. describe the indications for monitoring intracranial pressure, jugular venous bulb oxygen saturation and other relevant parameters, and their limitations
- e. explain the methods of manipulation of cerebral perfusion pressure and cerebral oxygenation, and discuss the available evidence that they benefit outcome
- f. describe how coma, confusion, delirium and acute weakness, and the treatment of these conditions, effect other organ systems
- g. explain the principles of outcome prediction in patients with coma, confusion, delirium and acute weakness.



### 1.2.3 PAEDIATRIC MEDICAL, SURGICAL AND NEONATAL CONDITIONS

#### INTRODUCTION

The trainee will be required to manage paediatric patients with a wide range of primary or complicating medical and surgical conditions. This includes resuscitation, thorough assessment, treatment and comprehensive continuing support. See Appendix 1 for a list of relevant conditions.

#### **Key Competency**

The novice trainee assists in management of a broad range of paediatric medical and surgical conditions, and the expert trainee leads the management. The expert trainee has developed a broad knowledge of diverse conditions, together with a detailed knowledge of those that may be life-threatening. The trainee manages these patients efficiently and safely.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the alterations to normal physiology produced by a variety of paediatric medical and surgical conditions, and the principles behind their management
- b. assist in the management of patients with these conditions.

*The expert trainee is able to also:*

- a. describe the pathogenesis of a variety of paediatric medical and surgical conditions
- b. diagnose and manage those conditions that are recognised to be within the domain of the paediatric intensive care specialist, including relevant aspects of chronic and co-morbid disease
- c. diagnose and manage other acute conditions until the appropriate specialist assistance is available
- d. recognise the need for operative intervention, and consult appropriately
- e. recognise the complications of common surgical procedures, and consult appropriately
- f. understand the effect of chronic disease processes (and their management) on the management and course of acute diseases.

#### **Examples:**

##### (i) **Sepsis**

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. define sepsis and related syndromes, and apply these definitions to diagnosis
- b. describe the concept of the pathogenesis of sepsis and related syndromes
- c. assist in the resuscitation of a patient with septic shock, using appropriate monitoring, fluid therapy and vasoactive agents
- d. take appropriate specimens for laboratory examination.

*The expert trainee is able to also:*

- a. ensure that appropriate microbiological specimens are obtained in a timely fashion, and act upon the results
- b. prescribe appropriate and timely antimicrobial therapy, based on the history, examination and preliminary investigations
- c. recognise whether there is a need for surgical intervention to treat the underlying cause, and consult appropriately
- d. recognise the multisystem effects of sepsis and instigate appropriate supportive therapy, including nutritional therapy
- e. describe the scientific basis of therapy based on modulation of inflammatory mediators, and recognise its limitations
- f. describe the risk factors for healthcare-associated infection, and use appropriate infection control measures to limit its occurrence.

## **(ii) Severe Trauma**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the effects of severe trauma on organs and organ systems
- b. explain the principles of management of the critically injured child, and the advantages of an organised system using a team approach.

*The expert trainee is able to also:*

- a) explain the principles of management of a mass casualty situation
- b) function as an appropriate trauma team member
- c) use a systematic approach to the resuscitation, assessment, investigation and emergency management of a critically injured patient
- d) prioritise life-threatening injuries requiring immediate intervention, including urgent surgical management
- e) prioritise the order of investigations for individual injuries according to their threat to life
- f) undertake those appropriate investigations in a safe and timely manner
- g) recognise those aspects in which the management of the injured child is different from that of the adult
- h) undertake the continuing management of the patient including the prevention, recognition and management of complications
- i) determine when the patient's needs exceed local resources, and arrange safe transfer
- j) describe injury severity scoring systems and their relationship to outcome, and use one system effectively.

## **(iii) Congenital Heart Disease**

### **Congenital Heart Disease**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the pathophysiological consequences of common congenital cardiac lesions
- b. recognise the signs and symptoms of congenital heart disease, provide differential diagnoses and formulate an approach to diagnosis and treatment
- c. describe congenital cardiac anomalies requiring time-critical intervention in the immediate post-natal period

- d. understand the basic principles of postoperative cardiac surgical care.

*The expert trainee is able to also:*

- a. recognise the complications of congenital cardiac lesions and the need for medical and surgical intervention
- b. describe and effectively implement basic and advanced principles of pre-operative stabilisation and post-operative cardiac intensive care
- c. recognise the indications for, commence and manage temporary cardiac pacing
- d. demonstrate a basic understanding of the value and limitations of investigations used in the diagnostic workup of the preoperative cardiac patient (e.g. echocardiography, cardiac catheterisation, angiography, radionuclide and MRI imaging of the heart)
- e. understand the long-term effects of congenital heart disease and associated conditions
- f. understand the management of patients with congenital heart disease who have concurrent illness or are undergoing anaesthesia and surgery
- g. explain a structured approach to perioperative extracorporeal life-support in congenital heart disease.

## 1.2.4 PICU THERAPY

### INTRODUCTION

Intensive care management involves therapy to reverse life-threatening physiological derangements as well as specific treatment of the underlying disease. The paediatric intensive care specialist must have an extensive knowledge of therapies commonly undertaken in the PICU, and their complications. These include pharmacological (e.g. inotropes), surgical, mechanical (e.g. mechanical ventilation) and other treatments (e.g. physiotherapy).

### **Key Competency**

The novice trainee describes the principles of treatment of physiological derangements and specific diseases, and initiates and monitors common therapies. The expert trainee critically appraises treatment options, and appropriately treats and corrects physiological derangements and specific diseases.

### **Enabling Competencies**

*The novice trainee is able to:*

-demonstrate a developing understanding of the range of treatments available for a specific physiological derangement or disease.

*The expert trainee is able to also:*

- a. describe when treatment is unnecessary or futile, and prioritise therapy according to patient need
- b. critically appraise the evidence for and against particular treatments, including the indications and contraindications
- c. explain the likelihood of success and the limitations of an individual treatment for a specific condition
- d. describe the complications of particular therapies and their incidence and management
- e. describe the effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment
- f. explain the concept of risk:benefit ratio of a therapy, and apply this concept to a particular patient
- g. describe the concepts of cost-effectiveness of a therapy and the value of a specific treatment to both the individual and the community
- h. formulate a plan of management for an individual patient
- i. review the efficacy of the chosen treatment at regular intervals, and institute alternative therapies, according to patient need
- j. review outcomes of specific therapies.

## **Examples;**

### **(i) Fluid Therapy**

#### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the causes and pathophysiological effects of altered intravascular volume and states of hydration
- b. demonstrate how to assess the intravascular volume status and state of hydration of a patient using clinical signs and monitoring
- c. describe the components, physical properties, and effects of administration of commonly-prescribed
- d. describe the indications, contraindications and complications of various fluid therapies and their administration
- e. explain the principles and risks of blood and blood component therapy.

*The expert trainee is able to also:*

- a. describe the theoretical advantages and disadvantages of crystalloid and colloid solutions
- b. choose the appropriate type, volume and rate of administration of fluid
- c. set goals, and regularly review the efficacy of fluid therapy
- d. consider and seek unidentified pathology (e.g. continued bleeding) if goals are not achieved
- e. institute an alternative fluid or drug regimen (e.g. inotropic therapy) if goals are not achieved.

### **(ii) Inotropic/Vasopressor Therapy**

#### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the physiology and anatomical distribution of adrenergic and other relevant receptors
- b. describe the effects of relevant inotropic/vasopressor agents on specific receptor populations
- c. recognise the need for inotropic or vasopressor therapy
- d. characterise the haemodynamic derangement, using clinical examination and invasive haemodynamic monitoring
- e. describe the limitations, potential adverse effects and complications of inotropic/vasopressor therapies.

*The expert trainee is able to also:*

- a. describe the effects of critical illness and concomitant therapies on receptor function (e.g. down-regulation)
- b. set goals for inotropic/vasopressor therapy
- c. choose an appropriate inotrope/vasopressor for the individual patient
- d. choose an appropriate dose, physiological endpoint, rate and route of administration of the selected inotrope/vasopressor
- e. describe the potential adverse effects and complications of inotropic/vasopressor therapy in general, and of individual medications
- f. explain the interactions among inotropic/vasopressor agents, between these agents and concomitant therapies, and between these agents and co-morbid disease
- g. review the efficacy of inotropic/vasopressor therapy at regular intervals
- h. consider and seek unknown pathology (e.g. sepsis) if goals are not achieved
- i. review the goals of therapy, and/or consider an alternative inotropic/vasopressor regimen if initial goals are not achieved
- j. follow a structured approach in decision-making and institution of extracorporeal life support (ECLS).

### **(iii) Respiratory Support**

#### ***Enabling Competencies***

*The novice trainee is able to:*

- a. demonstrate a sound knowledge of respiratory physiology and describe the effects of pulmonary pathology on physiological parameters
- b. recognise respiratory failure and know when intervention is necessary
- c. describe how to secure the airway safely and effectively
- d. describe the principles of oxygen therapy and oxygen delivery systems
- e. describe the principles of non-invasive and invasive respiratory support
- f. describe the principles of mechanical ventilation and mechanical ventilators

*The expert trainee is able to also:*

- a. describe the complications of endotracheal intubation, and take steps to minimise these
- b. use non-invasive ventilation appropriately and efficiently
- c. explain when and how to secure the airway safely and effectively, including the difficult airway
- d. describe the principles of the different modes of mechanical ventilation
- e. choose an appropriate type and mode of respiratory support for an individual patient
- f. describe the potential adverse effects and complications of the various types and modes of respiratory support, and take steps to minimise these
- g. recognise the degree to which cardiopulmonary interactions contribute to the clinical picture.
- h. set goals for respiratory therapy
- i. review the efficacy of therapy at regular intervals
- J. consider and seek problems (e.g. tube in right main bronchus, tension pneumothorax), and institute alternative respiratory and non-respiratory therapy if goals are not achieved
- k. follow a structured approach in decision-making and institution of ECLS.

## 1.2.5 TECHNICAL SKILLS

### INTRODUCTION

The expert trainee is proficient in a wide range of technical skills necessary for therapeutic and monitoring purposes, and safely teaches and supervises clinical practice. The ability to perform procedures must be accompanied by knowledge of normal anatomy, indications, contraindications and complications. The latter includes not only complications specific to the procedure, but potential delays in instituting important therapies whilst procedures are undertaken, and the possibility of obtaining and acting upon information that may be due to artefact.

### **Key Competency**

The novice trainee describes the relevant anatomy and preliminary measures to be undertaken, confirms that they have been done, and then performs core procedures under supervision, in a manner that minimises the risks of complications. The expert trainee confirms that preparation is complete and then either performs or supervises core procedures in a manner that minimises the risks of complications.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. perform core procedures
- b. seek senior supervision when performing non-core procedures, or when undertaking procedures beyond the trainee's experience
- c. describe the preparation required before undertaking a procedure
- d. describe relevant anatomy and how physiological function may be altered during the procedure
- e. describe the common complications, how to recognise them and institute appropriate management
- f. perform the procedure, and carry out continuing management in a manner that minimises the risks of complications.

*The expert trainee is able to also:*

- a. perform, teach and supervise the safe conduct of those procedures that are within the competence of the paediatric intensive care specialist
- b. seek expert help to perform those procedures that are not within his/her expertise.

**Examples include, but are not restricted to:**

- (i) placement of an intra-arterial catheter for continuous invasive blood pressure monitoring
- (ii) insertion of a central venous catheter
- (iii) insertion of a pleural drain.

## 1.2.6 SUPPORTIVE CARE OF THE CRITICALLY ILL PATIENT

### INTRODUCTION

Organ support is often required while injured tissues and organs heal and while the physiological consequences of illness and injury are corrected. Total patient care is central to the discipline of intensive care medicine. This includes support of the function of all organs, measures to prevent complications, and the alleviation of pain, anxiety and psychosocial distress. Social support should extend to the parents, carers and family.

### Support of Organ Function

#### **Key Competency**

The novice trainee understands that support of all organ systems is vital to the care of critically ill patients, irrespective of the organ or system primarily affected by the presenting illness. The expert trainee effectively delivers supportive management to the acutely ill patient.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the regulatory processes controlling the function of the individual organ or system
- b. describe how critical illness may affect homeostatic mechanisms
- c. recognise disorders of function of individual organs or system.

*The expert trainee is able to also:*

- a. explain the consequences of abnormal function of the particular system
- b. institute appropriate treatment for abnormal function of the particular system
- c. propose an appropriate supportive regimen for an individual patient.

**Examples include, but are not restricted to:**

#### **(i) Nutritional Support**

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe normal nutritional requirements
- b. describe the metabolic response to critical illness and starvation

*The expert trainee is able to also:*

- a. assess the nutritional requirements of critically ill children of all ages
- b. appreciate the adverse consequences of nutritional deficiencies
- c. appreciate the potential adverse consequences of nutritional support, including re-feeding syndrome and hyper-nutrition in PICU
- d. monitor nutritional status
- e. explain the advantages and disadvantages of different nutritional formulations and different routes of administration
- f. institute appropriate nutritional regimens for critically ill children.



## **(ii) Metabolic support**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the age-appropriate processes controlling fluid, electrolyte, acid-base and glucose balance
- b. recognise disorders of fluid, electrolyte, acid-base and glucose balance
- c. appreciate the pathophysiological consequences of disordered fluid, electrolyte, acid-base and glucose balance.

*The expert trainee is able to also:*

- a. treat abnormalities of fluid, electrolyte, acid-base and glucose balance
- b. institute an appropriate fluid and electrolyte regimen for an individual critically ill child.

## **(iii) General Care and Prevention of Complications**

The novice trainee describes the importance and principles of an appropriate plan for care of bowels, skin, mouth and eyes, and maintenance of mobility and muscle strength in critically ill children. The expert trainee institutes and revises an appropriate plan for care of bowels, skin, mouth and eyes, and maintenance of mobility and muscle strength in critically ill children.

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the predisposing factors and risk of development of a particular complication
- b. modify treatment to minimise the risk
- c. monitor appropriate parameters to allow early detection of the complication
- d. treat the particular complication effectively (e.g. pressure areas, constipation, corneal ulceration, contractures).

## **(iv) Pain Management**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the pain pathways and theory of pain generation
- b. describe the physiological and psychological effects of pain
- c. describe and use pain management techniques
- d. describe the pharmacology and roles of topical, enteral, parenteral and regional agents used in the treatment of acute and chronic pain.
- e. anticipate the development of pain and/or anxiety, and assist with strategies for their prevention or minimisation
- f. recognise and assess the degree of pain and/or anxiety
- g. describe the effects of analgesic, sedative and hypnotic drugs, and their uses and complications.

*The expert trainee is able to also:*

- a. describe the indications and contraindications for regional anaesthetic techniques, and use them appropriately
- b. propose and implement a plan to prevent and manage pain, anxiety and psychosocial distress depending on individual need, leading and supervising the novice trainee in the multi-modal management of pain

- c. anticipate, prevent and manage delirium and withdrawal syndromes.

#### **(v) Stress Ulceration**

##### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the normal gastric mucosal protective mechanisms
- b. explain the pharmacodynamics of different prophylactic regimens
- c. explain the rationale of a therapeutic plan for gastrointestinal bleeding.

*The expert trainee is able to also:*

- a. describe the pathogenesis and risk factors for stress ulceration
- b. describe the strengths and weakness of management strategies extrapolated from adult practice
- c. balance the benefits and risks of different prophylactic regimens
- d. propose and institute a therapeutic plan for gastrointestinal bleeding

#### **(vi) Healthcare-associated Infection**

##### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the normal innate and acquired immune defences and how they may be affected by acute illness and its treatments
- b. order and collect cultures of body fluids appropriately
- c. understand the principles of antibiotic stewardship and infection control.

*The expert trainee is able to also:*

- a. explain the risk of colonisation with potentially pathogenic micro-organisms, and the factors associated with patient, staff, equipment and environmental colonisation
- b. describe and implement infection control procedures relevant to the PICU, and demonstrate daily the importance of hand-washing and other preventative strategies.
- c. explain the advantages and disadvantages of collecting and culturing body fluids, and the principles of their collection
- d. delineate the difference between colonisation and invasive infection
- e. propose and implement plans for care of intravascular catheters and other invasive devices
- f. describe an antibiotic policy for the PICU
- g. efficiently manage individual patients with healthcare-associated infection.

#### **(vii) Ventilator-Associated Lung Injury (VALI)**

##### ***Enabling Competencies***

*The novice trainee is able to:*

Understand the potentially detrimental effects of mechanical ventilation.

*The expert trainee is able to also:*

- a. explain the pathogenesis, risk factors and clinical criteria sufficient for the diagnosis of ventilator-associated lung injury
- b. describe the potential complications of different forms of ventilation, and initiate appropriate protective ventilator management

- c. describe the manifestations of pulmonary barotrauma, volutrauma, atelectrauma and biotrauma
- d. describe the manifestations of absorption atelectasis and oxygen toxicity
- e. propose and implement a treatment plan for an individual patient with severe pulmonary barotrauma
- f. appreciate that superimposed lung injury in ventilated patients may result from many causes (e.g. super-infection, fluid overload, suctioning, inadequate humidification).

#### **(viii) Thromboembolic Disease**

##### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the normal haemostatic mechanisms and physiological anticoagulant systems
- b. describe the pathogenesis and risk factors for venous, arterial and intracardiac thrombosis and embolism.

*The expert trainee is able to also:*

- a. describe the age-related changes in haemostasis
- b. explain the benefits and risks of, and indications for, thrombo-prophylaxis.
- c. recognise the signs and symptoms of thromboembolism, and effectively confirm or reject the diagnosis
- d. implement timely and effective treatment for intravascular thrombosis, as well as pulmonary and systemic embolism

#### **(ix) Sleep Deprivation**

##### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the importance of diurnal rhythm and sleep to all patients
- b. describe how diurnal sleep rhythms are disturbed in PICU

*The expert trainee is able to also:*

propose and implement a plan to provide adequate rest and sleep in children in PICU.

## 1.2.7 MONITORING, MEASUREMENT, INVESTIGATIONS AND INTERPRETATION OF DATA

### INTRODUCTION

The expert trainee will acquire a broad knowledge of monitoring, measurement, investigations and the interpretation of data in PICU, built on an understanding of the physical principles. This includes an understanding of the indications, limitations and complications of techniques involved, and proficiency in the relevant technical skills, where these fall within the ambit of the paediatric intensive care specialist.

### Principles of Measurement

#### **Key Competency**

The novice trainee describes the principles of measurement as applied to the critically ill patient, and the expert trainee can use a wide range of relevant methods effectively and safely.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the physical principles of the system used
- b. identify deviations from age-appropriate ranges, and describe common causes for these
- c. describe how trend of change may be significant
- d. identify changes which are life-threatening, and respond accordingly
- e. recognise artefacts and/or errors.

*The expert trainee is able to also:*

- a. know when to monitor, measure or investigate
- b. set and safely adjust the acceptable limits of monitored parameters
- c. understand the risk/benefit ratio of the modality chosen
- d. evaluate and effectively act upon the information in a timely fashion
- e. recognise the limitations of interventions based on a single abnormality.

### Bedside Monitoring

***Examples include but are not limited to:***

#### **Continuous ECG monitoring**

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe how information relating to heart rate, rhythm, conduction, ST segment change and QT interval may be obtained
- c. describe the indications for ECG monitoring
- d. describe the limitations of ECG monitoring
- e. recognise changes which are potentially life-threatening.

*The expert trainee is also able to:*

- a. explain the advantages and disadvantages of different lead configurations
- b. set alarms appropriately

- c. differentiate real change from artefact
- d. respond appropriately to dysrhythmias and signs of ischaemia.

## **Invasive pressure monitoring**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the functions of the components of an invasive pressure monitoring system (catheter, tubing, transducer, amplifier and display unit)
- b. describe correct zeroing and calibration techniques
- c. describe the principles involved in optimising the dynamic response characteristics of the catheter-tubing-transducer set up, and how the natural frequency and damping coefficient determine the dynamics of the system
- d. describe the indications for invasive pressure monitoring
- e. describe the limitations of invasive pressure monitoring.

*The expert trainee is able to also:*

- a. understand the risk/benefit ratio of its use
- b. recognise change which is potentially life-threatening
- c. set alarms appropriately
- d. differentiate real change from artefact
- e. respond appropriately to changes and abnormal pressures.

## **Pulse oximetry**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the physical principles of pulse oximetry
- b. explain the indications for pulse oximetry
- c. explain the limitations of pulse oximetry and the causes of erroneous readings
- d. recognise changes which are potentially life-threatening.

*The expert trainee is able to also:*

- a. set alarms appropriately
- b. explain the limitations of pulse oximetry, and differentiate real change from artefact
- c. respond appropriately to abnormalities.

## **End-tidal CO<sub>2</sub> monitoring**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the physical principles involved in end-tidal CO<sub>2</sub> monitoring
- b. explain the relationship between end-tidal CO<sub>2</sub> and arterial PCO<sub>2</sub> in various clinical circumstances
- c. explain the indications for end-tidal CO<sub>2</sub> monitoring
- d. explain the limitations of end-tidal CO<sub>2</sub> monitoring.

*The expert trainee is able to also:*

- a. set alarms appropriately
- b. explain how common problems may affect the value measured or the capnograph appearance
- c. respond appropriately to the abnormalities detected
- d. evaluate the usefulness of volumetric CO<sub>2</sub> measurement in ventilator management.

## **Advanced haemodynamic monitoring**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the significance of, and the relationships between, central venous pressure, mean pulmonary artery pressure, pulmonary artery diastolic pressure, pulmonary artery wedge pressure, mean systemic arterial pressure and cardiac output, and how relationships may change in a range of clinical circumstances (e.g. cardiac tamponade, hypovolaemic shock)
- b. explain measurement of cardiac output by thermodilution and pulse contour analysis.

*The expert trainee is able to also:*

- a. explain the principles of measurement of cardiac output by multiple methods
- b. explain the indications for the use of a pulmonary artery catheter, echocardiography, PICCO etc.
- c. describe the risks and benefits of these techniques
- d. list the complications of the technique and methods to prevent them
- e. differentiate abnormality or real change from artefact
- f. explain how to derive additional indices (e.g. cardiac index, systemic and pulmonary vascular resistance index, left and right stroke work index, oxygen extraction ratio, oxygen delivery and consumption) and their relevance.

## **Cerebral dynamics monitoring**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the determinants of cerebral blood flow, cerebral perfusion pressure, CSF production and ICP
- b. describe the principles of intracranial pressure measurement and its relationship to cerebral perfusion pressure.

*The expert trainee is able to also:*

- a. use information derived from intracranial pressure measurement effectively in clinical practice
- b. know the indications for and limitations of intracranial pressure measurement
- c. understand the advantages and disadvantages of the different systems
- d. understand factors and therapies may influence intracranial and cerebral perfusion pressure
- e. recognises changes in intracranial and cerebral perfusion pressure which that are life-threatening, differentiate real change from artefact, and respond appropriately
- f. understand the risks and benefits of intracranial pressure measurement
- g. safely and efficiently manage an intracranial pressure monitor.

## **Laboratory Investigations Relevant to Intensive Care Practice**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the principles, range and reliability of the common laboratory tests relevant to intensive care practice, and request them appropriately.
- b. explain the indications for the investigations
- c. recognise changes that are significant and are potentially life-threatening
- d. respond appropriately to the result obtained.

*The expert trainee is able to also:*

- a. describe the causes of abnormality and sources of error
- b. explain the concepts of sensitivity, specificity and predictive value of the investigation in relation to a specific disease
- c. use results to assist in diagnosis and management
- d. obtain repeat or follow-up investigations as needed.

## **Organ Imaging**

### **Plain X-rays**

#### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the indications for a chest X-ray (CXR) in children in PICU
- b. describe the limitations of mobile CXRs in PICU patients
- c. describe the range of normal features on the CXR
- d. interpret a wide range of normal and abnormal CXRs
- e. explain and interpret the effect of projection, position, penetration and other factors on the image quality and radiological signs.

*The expert trainee is able to also:*

- a. recognise abnormalities, especially those which may be life-threatening, and respond appropriately
- b. propose a differential diagnosis based on the abnormalities observed
- c. relate the abnormalities to the clinical situation
- d. consult with the radiologist, and undertake further investigations when indicated.

## **CT scanning, MRI, ultrasound, angiography and radionuclide studies**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the indications for the procedure in PICU patients
- b. describe the limitations of the procedure in PICU patients
- c. explain the risks and benefits of the procedure (including transport)
- d. recognise common abnormalities in the PICU patient.

The expert trainee is able to also:

- a. act upon the result and seek specialist radiologist help to define more complicated problems
- b. propose a differential diagnosis based on the abnormalities observed
- c. relate the abnormality to the clinical situation
- d. undertake further consultation/investigation when indicated.

## **Diagnostic ECG**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the principles of diagnostic electrocardiography
- b. describe the indications for an ECG
- c. explain the limitations of the ECG
- d. Describe how the normal ECG changes during childhood
- e. interpret a wide range of abnormal ECGs

*The expert trainee is able to also:*

- a. explain the usefulness of specific leads in resolving difficult diagnostic issues (V4R - right ventricular infarction, atrial and oesophageal lead - SVT vs. VT)
- b. interpret abnormalities correctly
- c. recognise changes needing urgent intervention
- d. undertake appropriate treatment.

## **Respiratory Function Tests**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the physical principles of respiratory function tests
- b. describe the indications for ordering, and order the tests appropriately.

*The expert trainee is able to also:*

- a. interpret the various tests in light of the child's developmental age and capacity, and explain abnormalities correctly
- b. undertake appropriate treatment
- c. undertake further consultation/investigation where indicated.

## **EEG and Evoked Potentials**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. explain the principles of EEG and evoked potential recording
- b. describe the indications for EEG, SSEPs and BSEPs.

*The expert trainee is able to also:*

- a. explain the limitations of EEG and evoked potentials
- b. be guided by expert opinion in interpretation
- c. undertake appropriate treatment.



## **Selection of Apparatus**

### ***Enabling Competencies***

*The expert trainee is able to:*

- a. explain a need for the apparatus
- b. obtain an estimate of initial cost, availability of servicing and ongoing costs
- c. verify its accuracy against a known gold standard, where appropriate
- d. seek expert opinion, where necessary, to verify safety, reliability and compliance with recognised standards
- e. demonstrate its ease of use and acceptance by staff
- f. understand its limitations
- g. assign a priority to the need for the apparatus.

## **Electrical Safety**

### ***Enabling Competencies***

*The expert trainee is able to:*

- a. explain the difference between macro-shock and micro-shock, and the conditions which predispose to their occurrence
- b. describe the physical dangers of electrical currents
- c. explain the relevant standards document dealing with the safe use of electricity in patient care
- d. describe the basic methods by which electrical hazards are reduced
- e. seek expert help in ensuring that the PICU and all electrical equipment used in patient care conforms with, and is maintained to, the relevant safety standard.

## **Ionising Radiation**

### ***Enabling Competencies***

*The novice trainee is able to:*

- a. describe the hazards associated with ionising radiation
- b. seek expert opinion in limiting these hazards.

## **Information Technology**

*The novice trainee is able to:*

- a. define areas where computers and smart devices are helpful in learning and patient management
- b. use computers for accessing information, recording data, communication and record keeping
- c. maintain any and all social media presence to a professional and ethical standard.

*The expert trainee is able to also:*

- a. seek expert opinion on establishing computer services
- b. use technology and associated applications for research, data analysis and EBM.

### 1.3 PRE-INTENSIVE CARE UNIT, EXTRAMURAL CARE

#### 1.3.1 THE DETERIORATING PATIENT OUTSIDE PICU (Early Warning Systems, Medical Emergency Team or Rapid Response Team)

##### **INTRODUCTION**

It is important that all critically ill patients have access to optimal care, irrespective of their location. Patients who are admitted to PICU from the wards after deteriorating have a worse prognosis than those from other areas. Their deterioration may have been predicted by tracking key observations and prevented by triggering an early emergency response. The longer patients are in hospital before admission to PICU, the higher their mortality.

An appropriate emergency response requires (i) generation of appropriate triggering protocols, (ii) education of ward staff and (iii) organisation and supervision of a specialised team. This team must be, capable of providing a rapid response and solutions to acute medical and surgical problems in a cooperative manner.

##### **Key Competency**

The paediatric intensive care specialist explains the importance of recognising the deteriorating patient in the ward and organises, supervises and leads a rapid response team.

##### **Enabling Competencies**

*The novice trainee is able to:*

- a. define the role and rationale for the rapid response team
- b. describe an appropriate system for triggering the rapid response team
- c. describe the problems of caring for a critically ill patient in a non-ICU environment
- d. explain the priorities of caring for a patient with undifferentiated diagnosis in a non-ICU environment, assessing and simultaneously resuscitating as per 1.2.1
- e. play an effective role as junior member of the rapid response team, communicating effectively with the team leader and other members
- f. treat the ward staff with respect and empathy.

*The expert trainee is able to also:*

- a. effectively lead the rapid response team, and assist the priority areas of supporting the patients airway, breathing and circulation, whilst pursuing the cause for the trigger
- b. establish a plan of management for the patient which provides appropriate care, placement and follow-up
- c. communicate the care plan to treating teams
- d. assist in the education and organisation of the afferent and efferent limbs of the rapid response team.

## 1.3.2 CARDIOPULMONARY RESUSCITATION (CPR)

### INTRODUCTION

Cardiopulmonary resuscitation of a critically ill or injured child may be required within the hospital, in the PICU, emergency department or in a hospital ward or department, or outside the hospital, whilst on a patient retrieval or attendance at a disaster scene. An organised and rapid response is vital. The paediatric intensive care specialist is expected to lead, train and organise CPR, and apply the principles of resuscitation for respiratory or cardiorespiratory arrest in patients of all ages.

### Cardiopulmonary Resuscitation

#### **Key Competency**

The novice trainee explains that the time to basic life support and defibrillation are critical variables in the probability of survival from cardiac arrest, and describes and performs the algorithms for management of arrest scenarios. The expert trainee participates in and supervises cardiac arrest management in a range of settings and clinical situations as team member or leader.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the causes of cardiorespiratory arrest
- b. recognise symptoms and signs of impending or actual cardiac arrest
- c. explain the effects of cardiorespiratory arrest on body systems
- d. describe a plan of management for cardiac arrests due to shockable and non-shockable rhythms
- e. demonstrate techniques to clear and maintain the airway, the use of mouth-to-mask ventilation and the use of self-inflating hand-held resuscitators on patients and models
- f. describe the principles, and demonstrate techniques of, external cardiac compression in various age groups
- g. demonstrate combined ventilation and external cardiac compression in one-person and two-person rescue in various age groups
- h. describe the indications, and demonstrate the operation of, external defibrillators
- i. demonstrate techniques of access to the circulation
- j. diagnose cardiac arrhythmias
- k. describe anti-arrhythmic therapy in a cardiac arrest situation
- l. describe the latest protocols of the Australian Resuscitation Council for management of cardiorespiratory arrest in children (see website: [www.resus.org.au](http://www.resus.org.au)).

*The expert trainee is able to also:*

- a. seek and identify the cause in individual cases
- b. recognise and treat complications and sequelae of cardiopulmonary resuscitation
- c. counsel parents or carers of patients during and after cardiac arrest
- d. respond to an emergency in a positive, organised and effective manner, and direct the resuscitation team
- e. describe the indications to start and stop cardiopulmonary resuscitation
- f. manage the patient following resuscitation.

## **Organisation of Cardiac Arrest Response**

### ***Key Competency***

The expert trainee explains the organisation required for an effective cardiopulmonary resuscitation service within a hospital, and participates in a hospital response to internal and external emergencies.

*The expert trainee is able to:*

- a. explain the requirement for all areas within a hospital to have suitable equipment immediately available
- b. describe the appropriate equipment for areas within a hospital
- c. describe the requirement for attendance of appropriate personnel at the site of cardiorespiratory arrest
- d. explain the design and equipment requirements for a resuscitation facility
- e. explain the processes in organisation, training of personnel and procurement of equipment for response to internal and external emergencies.

## **Training of Medical and Other Staff**

### ***Key Competency***

The expert trainee assists in the training of medical, nursing and paramedical personnel.

*The expert trainee is able to:*

- a. teach techniques of cardiopulmonary resuscitation to different personnel
- b. describe the problems of resuscitation and crisis management which confront non-medical personnel.

### 1.3.3 TRANSPORT OF CRITICALLY ILL CHILDREN

#### INTRODUCTION

Transport of critically ill children is required in a number of circumstances, pre-hospital, intra-hospital for diagnostic and/or therapeutic interventions and inter-hospital for specialised diagnostic procedures and/or therapy. Transport may be required on an emergency or semi-elective basis. The principle governing transport of critically ill patients is to maximise safety and at the same time to maintain or improve the patient's clinical status during retrieval.

#### Organisation and Operation of Retrieval Services

##### **Key Competency**

The novice trainee describes the principles, problems and risks involved with transport of critically ill patients and assists in their application in hospital. The expert trainee applies this knowledge to ensure appropriate and safe transport of critically ill patients by supervising, teaching or participating in the transport in diverse settings. The expert trainee explains the College Policy Document IC-10: *Minimum Standards for Transport of Critically Ill Patients* (2010) and PS39: *Minimum Standards for Intra-hospital Transport of Critically Ill Patients* (2003)

##### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the principles underlying safe transport of critically ill children
- b. explain the importance of prior planning and organisation of retrieval services
- c. explain the requirement for stabilization and support of the critically ill child before transport is commenced
- d. describe the importance of communication between referring, transporting and receiving staff
- e. explain the need for specially designed equipment.

*The expert trainee is able to also:*

- a. describe the special equipment for transport, taking into consideration size, weight, battery life, durability and performance under conditions of transport
- b. explain how to select and train appropriate staff, based on patient need
- c. describe the advantages and disadvantages of road ambulance, fixed wing and rotary wing aircraft, including the problems associated with altitude, noise, vibration, acceleration and deceleration
- d. explain how to select the mode of transport, based on clinical requirements, distance, vehicle availability and environmental conditions
- e. describe the importance of pre-transport consultation and advice, especially when lengthy delays are anticipated
- f. explain the potential mental and physical trauma to the patient, and the traumatic effects of family dislocation
- g. Describe the operation of a networked retrieval service
- h. explain the need for complete documentation of the patient's clinical condition before, during and after transport, and of relevant medical conditions, therapy delivered, environmental factors and logistical difficulties encountered
- i. explain the need for regular audit of all aspects of retrieval, and application of quality improvement principles
- j. participate in safe transport of critically ill children in diverse circumstances

- k. explain the adaptation and application of general retrieval principles to pre-, intra- and inter-hospital transport.

### 1.3.4 OUTREACH, FOLLOW UP AND CONTINUING CARE OUTSIDE PICU

#### **INTRODUCTION**

Patients discharged to the ward following PICU admission have continuing problems that are within the knowledge base and expertise of the paediatric intensive care specialist. These patients may also deteriorate following discharge and require readmission to PICU. Therefore, it is important to follow the progress of these patients in the wards to prevent deterioration or treat continuing morbidity. Specific expertise may also facilitate earlier hospital discharge (e.g. tracheostomy care and facilitation of decannulation) and return to normal activity.

#### **Key Competency**

The expert trainee describes the consequences of severe illness, explains the importance of following the ICU patient in the ward and organises, supervises and leads a follow-up team.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. define the role of the follow-up team
- b. describe the medium and long-term consequences of severe illness
- c. play an effective role as junior member of the follow-up team, communicating effectively with the team leader and other members
- d. communicate clearly with the ward staff and patients, showing respect and empathy.

*The expert trainee is able to also:*

- a. effectively lead the team in detecting and treating deterioration, assisting in care within the expertise of the PICU team
- b. establish a plan of management that provides safe care for the patient
- c. assist in the education and organisation of the follow-up team.

## 2. COMMUNICATOR

### 2.1 PRINCIPLES OF COMMUNICATION

#### INTRODUCTION

The ability to communicate effectively is an essential attribute of the expert trainee. Such communication is particularly important when it involves patients and their families, as it facilitates the relationships and exchanges that occur with the staff. It aids shared decision-making and helps to establish rapport and trust, and aids information delivery and formulation of the diagnosis. Communicating effectively with colleagues facilitates teamwork and patient care.

#### Key Competency

The expert trainee explains the role of communication skills in the effective functioning of a PICU, teaches these skills and uses appropriate skills when communicating in a variety of roles. The trainee accesses relevant resources to develop communication skills to an appropriate level.

#### *Enabling Competencies*

*The novice trainee is able to:*

- a. explain the elements required to optimise the utility of family meetings (site, introduction, information-gathering, explanation, discussion, update, plan, review)
- b. communicate effectively with patients and relatives in PICU using active listening and appropriate language, adapting style to various contexts
- c. develop rapport, trust and empathetic relationships with patients and families
- d. elicit accurately and synthesise relevant information from patients, families and other available sources (e.g. neighbours, ambulance officers and police)
- e. accurately convey relevant information and explanations to patients, their family and colleagues.
- f. respect patient confidentiality, privacy and autonomy.

*The expert trainee is able to also:*

- a. encourage discussion, questions and interaction in meetings with patients and families
- b. apply the principles of open disclosure
- c. identify and analyse problems to be addressed after a family or patient meeting, including culture, context, concerns and responses
- d. describe the problems associated with difficult or stressful conditions (e.g. death, withdrawal of therapy, and organ donation)
- e. address challenging communication issues effectively (e.g. confusion, anger, requests for inappropriate therapies, obtaining informed consent, delivering bad or catastrophic news)
- f. communicate effectively with complex families and colleagues
- g. recognise where miscommunication has occurred, and take steps to seek help and address it
- h. assist families using appropriate resources (e.g. online information, books, videos).

## 2.2 CULTURAL COMPETENCE

### INTRODUCTION

PICU doctors work with culturally diverse groups. They need to be competent in dealing with patients and families of cultures different to their own. Culture affects the ways individuals understand health and illness, access health services, respond to interventions and communicate with services.

Cultural competence facilitates developing trusting relationships, gaining information from patients and families, improving relationships with patients and families, helping negotiate differences, increasing compliance with treatment and increasing patient satisfaction.

### **Key Competency**

The expert trainee is able to effectively use strategies to communicate with, and understand how, the needs, values and beliefs of patients and families from diverse cultures can be taken into account in caring for children and young people.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the existence and importance of cultural diversity
- b. describe that culture may relate to gender, race, personal traits, religion and country of origin
- c. describe how cultural diversity influences trust, communication, response to interventions and satisfaction
- d. respect different cultures
- e. describe the rights of patients and families to be treated with respect
- f. describe the rights of patients and families to privacy
- g. describe the rights of patients and families to be provided with services which take into account their needs, values and beliefs
- h. describe the importance of cultural competence.

*The expert trainee is able to also:*

- a. explain how his/her own culture will affect his/her interactions, decisions and actions and be aware of his/her own culture
- b. challenge cultural bias of others
- c. develop rapport with the patient and/or family and elicit cultural issues which may have an impact on management
- d. recognise the potential for conflict created by the competing requirements of the cultural and legal environment and the individual's needs, and work to resolve it.
- e. work effectively with interpreters, and seek assistance to better understand other cultures when required,



## 2.3 PROFESSIONAL COMMUNICATION: PRESENTATION SKILLS AND HANDOVER

### INTRODUCTION

The ability to communicate effectively is an essential attribute of the expert trainee. Such communication is particularly important when it involves other PICU staff (other specialists, junior medical staff, nurses and paramedical staff), referring or consulting medical staff from outside the PICU and hospital ward staff. Effectively and accurately conveying medical information between professionals is important in all aspects of ICU practice, particularly in clinical care of patients, handover, education and consultation. It requires a respect for others and their role in the hospital.

### **Key Competency**

The expert trainee is accurate and concise in relaying information about patients. The doctor confirms information and assures its reliability and consistency. The accuracy of written or electronic records is paramount. The trainee is able to deliver effective educational presentations to diverse audiences.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the importance of effective communication between medical and non-medical colleagues
- b. record accurate, structured and comprehensive clinical information in medical records, and provide accurate verbal information
- c. communicate effectively with peers and other staff, using the principles of teamwork
- d. give short presentations to peers on clinical topics, using audio-visual aids to facilitate message transfer.

*The expert trainee is able to also:*

- a. supervise accurate clinical information in medical records, and ensure accurate verbal information is relayed
- b. give effective presentations to diverse groups on clinical topics using audio-visual aids to facilitate message transfer.

## 2.4 END-OF-LIFE CARE

### INTRODUCTION

The care of the dying child is a prominent, challenging and important part of paediatric intensive care medicine.

### **Key Competency**

The expert trainee manages the process of limiting, withholding or withdrawing life-sustaining treatment in conjunction and collaboration with the child and family and other medical teams. The expert trainee describes and manages palliative care of the critically ill patient.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. recognise that the primary goal of medical treatment is to benefit the patient by restoring or maintaining the patient's health, maximising benefit and minimising harm.
- b. recognise that the application of medical technology may cause unnecessary and excessive suffering for patients and their families with little or no benefit.
- c. recognise that it may be appropriate to withdraw curative treatments and focus on promoting patient comfort when PICU therapies are of no benefit to the patient
- d. familiarise themselves with local legal responsibilities surrounding end-of-life care.

*The expert trainee is able to also:*

- a. take into account the opinion of the child and their family, the nature and probability of potential outcomes, and the costs to the patient of pain, suffering, loss of dignity and loss of identity, when withholding or withdrawing treatment
- b. support the competent patient's right to withdraw consent to treatment within the jurisdictional legal and statutory constraints, while ensuring fulfilment of the medical team's responsibility to fully inform the patient when making decisions.
- c. achieve medical consensus and assent from significant others, where this is necessary, before implementing end-of-life decisions
- d. recognise that for minors the 'best interests' standard is the paramount concern and, on rare occasions, this may be at odds with parental wishes
- e. implement an alternative care or comfort care plan, which focuses on relief of suffering, when death is imminent.

## 2.5 ORGAN DONATION

### INTRODUCTION

Organ donation is an important process that provides quality of life and survival benefit for recipients with end-stage organ failure. The expert trainee plays a crucial role in the appropriate and ethical practice of organ donation, against a backdrop of significant emotional stress to donor families.

### **Key Competency**

The paediatric intensive care specialist ethically and sensitively manages the process of organ donation and follows the ANZICS Statement on Death and Organ Donation.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. recognise that the paediatric intensive care specialist's first responsibility is to the ICU patient and to maintain that patient's rights and dignity
- b. familiarise themselves with the local legal requirements for certification of brain death and organ donation
- c. identify the potential donor as a critically ill patient receiving ventilator support in an intensive care unit after an acute brain injury.

*The expert trainee is able to also:*

- a. respect the wishes of the patient and family regarding organ donation
- b. explain the prerequisites for, and perform, brain death testing
- c. explain the circumstances under which organ donation after circulatory death may occur, and identify such potential donors in PICU
- d. explain the processes involved in organisation and conduct of organ donation after circulatory death
- e. communicate sensitively and effectively with the patient's family, the multidisciplinary PICU team and other medical teams
- f. explain and address common misconceptions surrounding organ donation
- g. provide the patient's family with a thorough explanation of the illness or injury, the prognosis and the intention to withdraw invasive or life-sustaining therapy before any discussion of organ donation
- h. describe clearly to the family the concept of brain death and/or circulatory death in the context of organ donation
- i. describe and manage the physiological support of the organ donor.

### 3. COLLABORATOR (TEAM WORKER)

#### 3.1 WORKING IN MULTIDISCIPLINARY TEAMS

##### INTRODUCTION

Teamwork is essential to the functioning of a PICU. Team support adds to the skills of other members of a team, and the effectiveness of the team is greater than the sum effectiveness of the individuals. Poor teamwork is a causal factor in many adverse events.

Good teamwork increases staff morale, satisfaction and efficiency. In a crisis teams may come together spontaneously, and roles, communication and tasks need to be rapidly clarified.

##### **Key Competency**

The expert trainee works with and leads a multidisciplinary team. The trainee supports and supervises that team with empathy and focus on the patients under the care of the team.

##### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the importance of teamwork in PICU and that collaboration is at the core of intensive care practice
- b. describe and respect the roles, skills and responsibilities of team members
- c. work effectively and sympathetically with peers and non-medical team members
- d. participate effectively in a multidisciplinary healthcare team
- e. communicate effectively with the team
- f. support the team.

*The expert trainee is able to also:*

- a. lead a team effectively
- b. explain the roles of individual team members
- c. support individual team members
- d. communicate effectively with all individuals in the team
- e. explain the principles of crisis resource management, feedback and debriefing
- f. recognise a poorly functioning team, analyse causes of the problems and propose solutions.

## 3.2 NEGOTIATION

### INTRODUCTION

Negotiation is an essential form of collaboration that allows parties with differing needs, backgrounds and agenda to find common ground and satisfactory outcomes..

#### **Key Competency**

The expert trainee uses negotiation skills to understand the needs of other parties, and to find solutions that minimise conflict and maximise effective use of resources, safe patient care and teamwork.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. demonstrate a respectful attitude to, and understanding of, other professional's priorities
- b. understand the expertise and backgrounds that other professionals bring to a negotiation.

*The expert trainee is able to also:*

- a. respect and acknowledge differences, misunderstandings and limitations in self and other professionals that may interfere with effective teamwork, collaboration or negotiation
- b. use the principles of negotiation to achieve appropriate results for each party in difficult discussions
- c. use the principles of negotiation to prevent conflict
- d. reflect on interpersonal communication, negotiation and collaboration, and strive to improve his/ her own skills.

### 3.3 CONFLICT RESOLUTION

#### INTRODUCTION

Conflict may occur in the PICU in diverse circumstances and involve colleagues, administrators, allied health professionals, patients and families in differing combinations and permutations. The environment of high stress; high risk; differing values, beliefs and culture and high workload make conflict more likely. Interpersonal and end-of-life issues are common sources of conflict.

#### ***Key Competency***

The paediatric intensive care specialist is able to anticipate sources of conflict, prevent escalation of conflict and effectively use available resources to defuse conflict.

#### ***Enabling Competencies***

*The expert trainee is able to:*

- a. describe the sources of conflict in a PCU environment
- b. describe the personality traits of self and others and how they may be associated with conflict
- c. explain the potential for conflict between the interests of the individual and the interests of the community
- d. explain the principles of conflict resolution
- e. use the principles of conflict resolution to resolve conflict.

## 4. MANAGER (LEADER)

### 4.1 ADMINISTRATION

#### INTRODUCTION

In addition to acquisition of clinical skills, the trainee becomes familiar with the broader activities of a paediatric intensive care specialist. These relate to the efficient running of a unit (administration, organisation, staffing, design and equipment), leadership, change management and the need for clinical audit and quality improvement programmes. Unit practice must be conducted according to ethical principles and fulfil medico-legal requirements. Participation in hospital committees, the organisation of scientific meetings, and the activities of professional organisations, societies and colleges are also desirable.

#### **Administrative Responsibilities of a Paediatric Intensive Care Specialist**

##### ***Key Competency***

The expert trainee describes the clinical and non-clinical roles of an intensive care specialist and explains how such activities contribute to the efficiency of the PICU, the profile of intensive care within the hospital and to the quality of patient management. The paediatric intensive care specialist contributes to a range of unit and hospital activities, and supports others in their roles.

##### ***Enabling Competencies***

*The expert trainee is able to:*

- a. describe the leadership role and the characteristics of good leadership
- b. lead the daily multidisciplinary ward round
- c. explain the duties of an intensive care specialist and the director of the department
- d. describe the principles of administration and management
- e. describe the principles of change management
- f. critically analyse and, where appropriate, facilitate the adoption of guidelines, protocols and care bundles.
- g. assist with ensuring unit compliance with infection control protocols
- h. refer to the appropriate standards and know the physical requirements of PICU design
- i. identify occupational and safety hazards and adopt measures to reduce them
- j. recognise impaired performance in self and in professional colleagues
- k. describe the principles of complaint resolution and dealing with anger in self and others
- l. contribute to professional meetings and understand their rules, structure and etiquette
- m. describe the basic principles involved in organising a scientific meeting
- n. explain the ethical and legal implications of intensive care practice.

## 4.2 LEADERSHIP

### INTRODUCTION

All senior doctors are expected to lead at various times. The expert trainee will frequently face situations in the PICU, hospital wards and the Emergency Department that require specific leadership skills. Leadership is learnt, and may be described as the process of constructively influencing an organised group (e.g. PICU multidisciplinary team or Paediatric Intensive Care Medicine department) in goal-setting and achievement of those goals.

### **Key Competency**

The expert trainee leads a multidisciplinary team effectively and supports the department leader, constructively influencing decisions, disseminating knowledge and managing conflict.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. identify the important determinants of effective leadership
- b. explain the difference between leadership and management.

*The expert trainee is able to also:*

- a. explain that the role of a leader is situational and context-dependent (e.g. ward round, trauma team, hospital meeting)
- b. explain that the role of the leader requires knowledge and emotional intelligence, including self-awareness, empathy and communication
- c. explain that a good leader has clear vision, trust from the team, is organised, delegates appropriately and communicates effectively
- d. describe the leadership roles and opportunities for PICU staff in the hospital and wider community.



## 4.2 QUALITY ASSURANCE AND IMPROVEMENT

### INTRODUCTION

There are many aspects of quality management in PICU. Quality domains are varied and vitally important to ICU practice and patient outcome. They include safety (freedom from harm), effectiveness (use of evidence based therapy), efficiency (eliminating waste), patient-centredness (taking account of the patient's real needs), timeliness (care provided when needed) and equitability (care independent of wealth, race, religion or gender).

### **Key Competency**

The expert trainee is able to organise a quality improvement program and run its components to ensure delivery of all quality domains. The trainee will undertake clinical audit and perform effective quality improvement activities, including morbidity and mortality review, case conferences, root cause analysis, incident monitoring and adverse event assessment, and ensure that the information gathered is used effectively to prevent subsequent events.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. describe the need for, and importance of, clinical audit (e.g. mortality reviews, complications etc.) and review other clinical indicators
- b. describe the sources of medical error
- c. describe the purpose and process of other quality improvement activities, such as evidence based practice, best practice guidelines, benchmarking and critical pathways
- d. assist with data collection and clinical audit

*The expert trainee is able to:*

- a. recognise the need for clinical audit and quality improvement activities not to be seen as threatening or punitive to individuals
- b. undertake clinical audit and lead effective quality improvement activities.
- c. describe how medical error may be reduced and an effective culture engendered
- d. encourage others to participate in clinical audit and quality improvement activities
- e. comply with CICM recommendations for quality improvement activities (Document IC-8 Quality Assurance).

### 4.3 RESOURCE MANAGEMENT

#### INTRODUCTION

Health resources are finite and require effective and efficient management to ensure maximum benefit to the hospital and community. Management includes securing maximum resources available and the efficient use of the resources.

#### ***Key Competency***

The expert trainee explains that the resources of a PICU are many, diverse and valuable. They include personnel, equipment, structures and intellectual property. They require maintenance and careful acquisition.

#### ***Enabling Competencies***

*The novice trainee is able to:*

Explain that the role of the intensive care specialist goes beyond the care of individual patients and involves many aspects of resource management, including organisation, purchasing, financial planning, rostering, strategic planning and committee work.

The expert trainee is able to also:

- a. explain the basic principles of departmental budgeting, financial management and resource utilisation
- b. explain the factors that determine the optimum staff establishment for specialist and junior medical staff, nurses, paramedical and secretarial staff
- c. describe the process for selecting, ordering and maintaining equipment
- d. describe the processes for attracting, selecting, appraising and encouraging effective staff.

## 4.4 EQUIPMENT ASSESSMENT

### INTRODUCTION

Equipment has vital functions in PICU. It may be single-use, disposable, multi-use or structural and permanent. Equipment is varied and can be used for resuscitation, life support, acquisition and storage of information, accommodation and transport of patients. Efficient purchase requires rigorous assessment and planning of requirement.

### **Key Competency**

The expert trainee is able to use and assess a broad range of equipment for diverse purposes in the ICU. The assessment process is equipment- and role-specific, and includes questions of risks, advantages, disadvantages, compatibility, labelling, usability, cost, evidence of benefit, durability, usage and safety.

### **Enabling Competencies**

*The novice trainee is able to:*

explain the strategic role of the intensive care specialist in assessing, planning and purchasing equipment.

*The expert trainee is able to also:*

- a. explain criteria for assessment of a range of equipment
- b. explain the risks of inadequate equipment assessment
- c. assess examples of disposable, multi-use and permanent equipment by a range of criteria.

## 5. HEALTH ADVOCATE

### 5.1 PATIENT

#### **Key Competency**

The expert trainee uses expertise and influence to advance the health and wellbeing of individual patients beyond the care of the specific critical illness.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. identify the important determinants of health affecting patients, including occupational and environmental exposures, product safety, socio-economic factors and lifestyle factors
- b. contribute effectively to the improved health of individual patients
- c. assist individual patients in navigating the healthcare system and accessing health care and resources.

*The expert trainee is able to also:*

- a. understand the importance of medico-legal and insurance considerations for critically ill patients and their families
- b. advocate for patients in their dealings with other health professionals
- c. advocate for patients who are unable to advocate for themselves.

### 5.2 COMMUNITY

#### **Key Competency**

The expert trainee explains that paediatric intensive care specialists use their expertise and influence to advance the health and wellbeing of communities and populations beyond the walls of the ICU, by public advocacy and committee membership, and that their focus is on the interests and needs of society.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. outline the healthcare system and the structure, function and financing of ICUs within the local and national system
- b. identify the determinants of health in the population served
- c. identify the needs of intensive care patients within the community.

*The expert trainee is able to also:*

- a. communicate critical care issues to the general population, and describe their impact on the maintenance and improvement of health care
- b. describe the professional issues involved in health advocacy, including altruism, social justice, autonomy, integrity and idealism
- c. actively promote risk reduction and patient safety
- d. explain how the intensive care specialty should respond to the needs of the community in general
- e. explain the potential role of the paediatric intensive care specialist in improving the standard of health care in the community.

## 6. SCHOLAR (EDUCATOR)

### 6.1 RESEARCH & EVIDENCE-BASED PRACTICE IN INTENSIVE CARE

#### INTRODUCTION

The expert trainee evaluates the medical literature as a basis for continuing education, maintenance of professional standards and continuous quality improvement of patient care. The expert trainee contributes to the development of new knowledge, and undertakes and fosters high quality clinical research. For this to be achieved, an extensive knowledge of scientific processes and ethics is required.

#### Teaching and Learning through Research

##### **Key Competency**

The expert trainee explains and uses the scientific approach and evidence-based medicine in continuing education and educational activities.

##### **Enabling Competencies**

*The novice trainee is able to:*

describe the steps involved in both hypothesis-generated research (e.g. evaluation of a therapeutic agent) and observational research.

*The expert trainee is able to also:*

- a. demonstrate the expertise to appraise levels of evidence for diagnostic tests, therapy, interventions and prognosis, including integrative literature (systematic reviews, meta-analyses, practice guidelines and economic analyses)
- b. evaluate, when necessary, the evidence for complementary therapies, and deal with requests for therapies with limited scientific basis in a professional manner
- c. explain the importance of good record-keeping in research
- d. describe ethical considerations in research involving human or animal subjects
- e. prepare protocols appropriate for both experimental and non-experimental research methods.

#### **The Scientific Method**

##### **Identifying the need for investigation**

##### **Key Competency**

The expert trainee describes the difference between those patterns of practice that have a sound scientific basis and those that may require further objective assessment, and seeks to advance knowledge.

**Enabling Competencies**

*The novice trainee is able to:*

identify observations that are unusual or unexplained and worthy of investigation.

**Formulating the hypothesis****Key Competency**

The expert trainee describes and uses the process of advancing a theoretical explanation for an observation.

**Enabling Competencies**

*The expert trainee is able to:*

- a. use logical processes, based on acquired knowledge or experience, to formulate a hypothesis
- b. access information from the literature using electronic databases and retrieval tools
- c. identify underlying scientific principles that may govern the observed events.

**Reliability of proposed method in investigation****Key Competency**

The expert trainee describes and uses the principles of experimental trial design and methods of measurement.

**Enabling Competencies**

*The expert trainee is able to:*

- a. explain concepts of validity, reproducibility and accuracy in the application of measurement techniques
- b. seek out locally-available resources and assistance
- c. explain how to validate selected methods.

**Experimental Design****Writing a protocol and seeking advice****Key Competency**

The expert trainee describes and uses the process required to develop a research protocol, including using expert advice.

**Enabling Competencies**

*The expert trainee is able to:*

- a. demonstrate the ability to organise, or assist in organising, a written description of the proposed method of study. seek advice from others with interest or expertise in the field of study
- b. communicate and collaborate with other research staff.

## **Statistical advice**

### **Key Competency**

The expert trainee explains the need to have sound statistical knowledge and/or advice before finalising a research proposal.

### **Enabling Competencies:**

*The expert trainee is able to:*

Explain the important relationship between sample size and the statistical power of the investigation.

## **Ethical considerations**

### **Key Competency**

The expert trainee describes both the ethical principles involved in conducting research and the need for institutional ethics committee approval of the proposed research.

### **Enabling Competencies**

*The novice trainee is able to:*

- a. explain the ethical principles that support the priority of informed consent and subject autonomy in clinical research
- b. explain the importance of clear communication of potential risks, discomforts and benefits to the subject from participating in the study, and the right to withdraw from the study without compromising care.

*The expert trainee is able to also:*

- a. describe the jurisdictional regime under which clinical research can be carried out
- b. describe the important protections that this regime provides for both the patient and the researcher
- c. demonstrate the ability to organise, or assist in organising, a written application to the institutional ethics committee for approval of the proposed research
- d. contribute to effective clinical research endeavours through obtaining patient consent, compliance with protocols, documentation and communication.

## **Obtaining and Using Resources**

### **Key Competency**

The expert trainee explains the process by which research funds are obtained and how to write a grant application.

### **Enabling Competencies**

*The expert trainee is able to:*

- a. prepare, or assist in preparing, a grant application
- b. explain the importance of interdisciplinary co-operation and sharing of scarce research resources, equipment and facilities.

## **Statistical Analysis**

### **Choosing and applying appropriate statistical tests**

#### ***Key Competency***

The expert trainee describes the principles of statistical inference.

#### ***Enabling Competencies***

*The expert trainee is able to:*

- a. describe the importance of basic statistical concepts (e.g. distribution of data, comparisons of distributions and their tests, probability, confidence intervals, permitted departures from distributional assumptions, parametric and non-parametric statistical tests)
- b. describe potential errors in interpretation and application of statistics.

## **Interpretation of results**

#### ***Key Competency***

The expert trainee draws relevant conclusions from the data derived from a study.

#### ***Enabling Competencies***

*The expert trainee is able to:*

- a. describe the limitations of investigations
- b. describe what inference is reasonable from the results.

## **Data Presentation**

#### ***Key Competency***

The expert trainee explains the principles and develops the skills to effectively communicate data.

#### ***Enabling Competencies***

*The expert trainee is able to:*

- a. prepare a manuscript for submission to a journal
- b. prepare visual material for the effective communication of data and concepts as oral or poster presentations
- c. present papers and posters at meetings.



## 6.2 TEACHING

### INTRODUCTION

Teaching of medical colleagues and other health professionals is both a responsibility and a continuing learning experience for the expert trainee. The expert trainee demonstrates a lifelong commitment to dissemination, application and translation of medical knowledge into appropriate practice. An understanding of educational principles will support the process of continuing education throughout professional life.

### **Key Competency**

The expert trainee understands that teaching is an ongoing responsibility, and can use the principles of adult learning to be an efficient teacher.

### **Enabling Competencies**

*The expert trainee is able to:*

- a. use the principles of adult education to promote teaching
- b. describe the value of educational objectives, and write objectives for personal needs and for an education programme
- c. recognise and use the teaching and learning opportunities arising from clinical experience
- d. use the opportunities for learning that arise from personal communication
- e. describe the range and qualities of written and audio-visual material, interactive computer programmes and other software, in order to make best use of their potential for teaching and learning
- f. recognise that properly conducted research and a commitment to the scientific method are major contributors to teaching and learning
- g. explain how evaluation can improve learning and teaching
- h. explain the importance of certification examinations, and know how to assess validity and reliability of such processes.

### 6.3 CLINICAL SUPERVISION AND MENTORING

#### INTRODUCTION

Supervision of junior colleagues and other health professionals is both a responsibility and a continuing learning experience for the expert trainee. Supervision should be available at all times for doctors in training. The expert trainee demonstrates a commitment to reliable supervision, not only in clinical situations, but also in record keeping, audit and teaching of junior doctors.

The expert trainee explains that the mentor differs from the supervisor; a mentor takes the role of a trusted friend or counsellor, and is usually a more experienced person.

#### **Key Competency**

The expert trainee understands that supervision is an ongoing responsibility of senior doctors and a right of junior doctors, and that mentoring aids in the development of the individuals involved and the team.

#### **Enabling Competencies**

*The expert trainee is able to:*

- a. supervise junior doctors assessing, resuscitating and providing continuing care to critically ill patients
- b. supervise junior doctors performing complex procedures in critically ill patients
- c. be a mentor for, provide advice to and be an example to junior doctors
- d. provide advice and assistance to less experienced colleagues, to help them advance their careers, enhance their education, and build networks.

### 6.4 LIFELONG LEARNING and REFLECTION

#### INTRODUCTION

Learning all aspects of the practice of paediatric intensive care medicine is fundamental to becoming a competent specialist. As the practice of intensive care medicine is incrementally changing and the knowledge base rapidly increasing, it is important that learning, enquiry and reflection continue beyond training.

#### **Key Competency**

The expert trainee understands that learning is an ongoing right and responsibility, and can use the principles of adult learning to be an efficient lifelong learner and teacher. The trainee develops, implements and monitors a personal continuing education strategy.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. explain that learning is most effective when derived from experience of the learner and from active participation in the learning process
- b. explain that when teaching or learning, a problem-solving mode, rather than a solution-giving mode, is required
- c. describe the requirement for critical analysis and information assimilation from multiple sources, rather than dependence on any particular expert
- d. explain that objectives are best met when they arise out of the interests and needs of the learner
- e. explain that the relationship between learner and teacher should be characterised by mutual trust, acceptance and respect
- f. explain that feedback from teacher and peers provides benefit and support

- g. explain that the environment for learning needs to be physically comfortable
- h. explain that humour and laughter, in an appropriate context, may improve the learning climate.

*The expert trainee is able to also:*

- a. facilitate the learning and enquiry of patients, families, students, trainees and other health professionals
- b. use constructive and specific feedback to guide learning by others
- c. fulfil the CPD/MOPS requirements of the College.

## 7. PROFESSIONAL

### 7.1 ETHICS and the LAW

#### INTRODUCTION

An understanding of the principles of ethics and the local legal framework is essential for development and maintenance of the highest standards of practice, teaching and research in paediatric intensive care.

#### **Key Competency**

The expert trainee delivers the highest quality care with integrity, honesty and compassion, and applies knowledge of ethics and law effectively and with cultural competence. The novice trainee describes the concepts of patient autonomy, beneficence, non-maleficence and justice (as it applies to fair distribution of resources). The expert trainee applies those ethical and legal principles in daily clinical practice.

#### **Enabling Competencies**

*The novice trainee is able to:*

- a. explain that patients or their guardians have certain rights to accept or reject a treatment being offered (with due regard to the principles of truthful disclosure, informed consent and the rights of the child)
- b. explain the issues and principles involved in withholding and withdrawing life-sustaining treatment, and the care of the dying patient
- c. explain that the decision to withhold or withdraw potentially curative or life-sustaining treatment does not imply the termination of care.

*The expert trainee is able to also:*

- a. demonstrate an understanding of the principles from which they derive their moral and ethical approach to work and life
- b. demonstrate an awareness and understanding of alternative approaches to the formulation of ethical priorities – whether religious, cultural or otherwise
- c. describe the legal and ethical framework under which they are authorised to provide patient care, undertake research and prescribe medications
- d. understand how the legal and ethical framework varies when patient care involves minors or those otherwise incapable of exercising autonomy
- e. explain the ethics of resource allocation in the face of competing claims to these resources
- f. explain the legal issues and principles involved in the diagnosis of brain death and the process of organ donation, and demonstrate that understanding using role-play
- g. explain that when patients are involved in teaching, the principles of consent, privacy and non-maleficence must be maintained
- h. explain the ethical and legal principles involved in conducting research, and the need for institutional ethics committee approval of the proposed research
- i. describe that the well-being of the patient takes precedence over the interests of society or research
- j. explain that the best interests of minors must be the paramount consideration in decision-making affecting the care of infants, children and young people
- k. behave with integrity and honesty and accept responsibility for his/her personal physical and mental health, especially where impairment of health affects patient care and professional conduct.

## 7.2 PROFESSIONAL BEHAVIOUR

### INTRODUCTION

An understanding of the norms of professional behaviour is essential for development and maintenance of the highest standards of practice, teaching and research in intensive care, characterised by profession-led regulation and high personal standards of behaviour.

### **Key Competency**

The expert trainee delivers the highest quality care with integrity, honesty and compassion.

### **Enabling Competencies**

*The novice trainee is able to:*

describe the different behaviour patterns encountered in practice, and explain the advantages of truly professional behaviour and the disadvantages of aberrant behaviour.

*The expert trainee is able to also:*

- a. behave with integrity and honesty, and accept responsibility for his/her personal physical and mental health, especially where impairment of health affects patient care and professional conduct
- b. demonstrate awareness of the mental and physical well-being of colleagues.

## **APPENDIX 1 - REPRESENTATIVE LIST OF PAEDIATRIC MEDICAL, SURGICAL AND NEONATAL CONDITIONS**

The novice trainee is able to describe how congenital syndromes and disorders and other co-morbidities may complicate acute medical and surgical conditions in children. The expert trainee will be able to also recognise, confirm the diagnosis of, explain the pathophysiology of, treat and prevent complications associated with the following conditions:

### **Cardiovascular Disorders**

Cardiogenic shock	Pericardial disease (tamponade, constriction)
Cardiac dysrhythmias	Systemic/pulmonary hypertension
Conduction disturbances	Arterial embolus/thrombosis
Congestive cardiac failure	Peripheral arterial disease
Myocardial ischaemia	Deep vein thrombosis
Cardiopulmonary arrest	Pulmonary embolism
Cardiomyopathy, myocarditis (including Kawasaki disease)	Vena cava obstruction syndromes
Endocarditis (infective and non-infective)	Postoperative care after heart surgery
Congenital heart disease	Care after interventional cardiac procedures
Valvular heart disease	Heart transplantation and complications

### **Respiratory Disorders**

Respiratory failure (type I and II)	Collapsed lung or lobe
Acute lung injury/ARDS	Interstitial lung disease
Neonatal respiratory distress syndrome	Cystic fibrosis
Meconium aspiration syndrome	Pulmonary haemorrhage syndromes
Congenital diaphragmatic hernia	Asthma and complications
Chronic lung disease	Pulmonary abscess
Airway obstruction (upper and lower, congenital and acquired)	Mediastinal and thoracic tumours
Pneumothorax	Pleural disease (e.g. empyema, effusion, pneumothorax, haemothorax)
Aspiration syndromes	Tracheobronchomalacia and stenosis
Fat embolism	Diseases of the diaphragm
Pneumonia (community, hospital acquired)	Bronchopleural fistula
Pneumonitis	Postoperative care after thoracic surgery
	Congenital lung abnormalities

### **Renal Disorders**

Acute renal failure	Congenital renal abnormalities
Renovascular disease	Malignancy of renal tract
Renal/Urinary tract infection	Nephrotic syndrome
Urinary obstruction	Tubular disorders (RTA, ATN)
Glomerulonephritis	Nephrolithiasis
Rhabdomyolysis	Interstitial nephritis
Haemolytic uraemic syndrome	Renal transplantation and complications

## **Central Nervous and Neuromuscular Disorders**

Acute vascular disorders

- haemorrhage (subarachnoid, extradural, subdural, intracerebral, intraventricular)
- thrombosis
- embolism
- vasculitis

Infective disorders (meningitis, encephalitis)

Non-infectious encephalopathies and encephalitis

Global and local cerebral ischaemia

Brain death determination

Persistent vegetative state

Cerebral neoplasm (primary or secondary)

Seizures

Neurodevelopmental disease

Spinal cord disorders- paraplegia, quadriplegia

Acute polyneuritis (e.g. Guillain Barre syndrome)

Critical illness neuropathy/myopathy and disorders of the neuromuscular junction

Myasthenia gravis

Toxic encephalopathy

Bulbar palsy

Hyperthermia

Hypothermia

Delirium (management and prevention)

Psychiatric emergencies

Care after major neurosurgery

Cerebral palsy

## **Endocrine Disorders**

Diabetes mellitus and acute glucose handling disorders

Hypothalamic-pituitary axis disorders

Adrenal disorders (acquired and congenital)

Complications of steroid therapy

Acute thyroid disorders

Hormonal responses to critical illness

Phaeochromocytoma

Obesity

Care after pituitary, adrenal, thyroid and parathyroid surgery

## **Metabolic Disorders**

Metabolic response to stress, sepsis, starvation, surgery and trauma

Electrolyte and acid-base disorders (including Na, K, Ca, Mg, PO<sub>4</sub>, Cl)

Malnutrition

Overfeeding

Re-feeding syndrome

Congenital metabolic disorders

Chromosomal and non-chromosomal syndromes

## **Haematology**

Anaemia and polycythaemia

Neutropenia, leukopenia,

Thrombocytopenia

Neutrophilia, leukocytosis, thrombocytosis

Disorders of coagulation & haemostasis

(e.g. disseminated intravascular coagulation, fibrinolysis, thrombophilia)

Transfusion medicine: compatibility, matching, storage, massive transfusion, and transfusion reactions

Bone marrow transplantation and complications

Haemolytic uraemic syndrome and thrombotic thrombocytopenic purpura

Massive transfusion

Acute haemolytic disorders

## **Immunology, Rheumatology**

Severe drug reactions: TEN, Stevens –Johnson Syndrome

Anaphylaxis

Complications of transplantation (e.g. organ rejection)

Immunosuppression

Human immunodeficiency virus (HIV) infection and its complications

Autoimmune connective tissue disease (e.g. Juvenile rheumatoid arthritis, systemic lupus erythematosus, polyarteritis nodosa)

Non-immune connective tissue disease (e.g. CREST, Marfans Syndrome)  
Vasculitides  
Congenital vascular/lymphatic malformations

### **Oncology**

Tumour lysis syndrome  
Childhood haematological malignancies  
The oncology patient in PICU (risk prediction, supportive care)  
Complications of chemotherapy

### **Gastrointestinal Disorders**

Congenital malformations (incl. oesophageal and duodenal atresia, trachea-oesophageal fistula, malrotation, volvulus, intussusception, Hirschsprungs disease)  
Abdominal wall defects,  
Oesophageal disease (e.g. varices, rupture, obstruction, achalasia)  
Gastrointestinal bleeding (upper, lower)  
Paralytic ileus, gastric dilatation  
Ischaemia or infarction of gut  
Bowel obstruction  
Inflammatory bowel disease  
Necrotising enterocolitis  
Pseudo-membranous colitis  
Neutropenic enterocolitis  
Megacolon  
Peritonitis and intrabdominal sepsis

Post-operative GIT problems (e.g. leaking anastomosis, fistula, blind loop syndrome)  
Malabsorption (including short gut syndrome)  
Ascites  
Pancreatitis  
Hepatic and biliary disease (congenital and acquired)

- acute hepatic failure
- chronic liver disease/portal hypertension
- jaundice (obstructive and non-obstructive)
- calculous and acalculous cholecystitis
- cholangitis

Liver transplantation and complications

### **Infectious Disorders**

Serious Infections - (bacterial, viral, fungal, rickettsial and protozoal)

Specific system infections

- CNS: meningitis, encephalitis
- respiratory: croup, epiglottitis, tracheobronchitis, pneumonia
- soft tissue: necrotising fasciitis, cellulitis
- gastrointestinal: hepatitis, colitis, pancreatitis, peritonitis

- genitourinary: pyelonephritis, urinary tract infection

Tetanus

Botulism

Community-acquired infection

Healthcare associated infection

Antibiotic resistance

- Superantigen syndromes, including toxic shock syndrome



### **Dermatological Disorders**

Erythema multiformae  
Toxic epidermal necrolysis  
Scalded skin syndrome

Cutaneous manifestations of systemic diseases

### **Trauma**

Hypovolaemic Shock  
Maxillofacial and airway injuries  
Chest injuries  
Aortic and myocardial injury  
Abdominal trauma  
Neurotrauma  
Acute spinal cord injury  
Pelvic injuries  
Long bone trauma, crush injury, compartment syndrome and rhabdomyolysis  
Non-accidental injury

### **Toxic, Chemical, Physical Injuries**

Drug overdose, common poisonings, and toxidromes  
Ingestion or inhalation of corrosive or toxic substances  
Burns  
Envenomation  
Electrical injury  
Decompression syndromes  
Altitude sickness

- Hyperthermia (including MH, SS, classical and exertional)
- Hypothermia
- Drowning episodes
- Air embolism

### **Perioperative care**

Patients after high-risk surgery (complex or protracted with serious physiological perturbations)  
The high-risk patient (severe co-morbidities) after surgery  
Risk prediction and optimisation pre- and post-operatively

## **APPENDIX 2 - REPRESENTATIVE LIST OF THERAPIES**

The expert trainee understands the mode of action, indications, contraindications, safe use and prevention of complications of intensive care treatments. The expert trainee is able to use and supervise the use of these treatments including:

### **Universal precautions, isolation procedures, sterile precautions**

#### **Fluid Therapy and nutrition**

crystalloid  
colloid  
enteral and parenteral nutrition

blood transfusion  
blood component therapy

#### **Drug Therapy**

inotropic agents  
vasoconstrictors  
anti-arrhythmics  
analgesics  
sedatives  
neuromuscular blockade  
antiulcer therapy  
bronchodilators  
antimuscarinics  
antihypertensives  
antimicrobial agents  
antidotes to poisons  
hyperosmolar therapies

anti-platelet medications  
anticoagulants  
anti-fibrinolytics  
corticosteroids  
anticoagulants  
thrombolytics,  
fibrinolytics  
procoagulants  
anticonvulsants  
antimicrobial agents  
hormonal agents (e.g. octreotide)

#### **Respiratory Therapy**

oxygen therapy  
humidified high flow nasal cannula oxygen  
ventilation (non-invasive, invasive)  
high frequency oscillatory ventilation  
weaning from ventilation  
humidification  
nebulisers

suction systems  
inhaled nitric oxide  
inhaled prostacyclin  
heliox  
tracheostomy  
respiratory ECMO

#### **Cardiac Support**

inotropes, vasoconstrictors, vasodilators  
cardiac pacing  
extracorporeal support (e.g. ECLS, VAD)

**Renal Replacement Therapy**

CRRT (haemo (dia)-filtration) techniques  
plasmapheresis  
haemodialysis  
peritoneal dialysis  
haemoperfusion

**Analgesia and anaesthesia**

patient-controlled analgesia  
total intravenous anaesthesia for procedures  
spinal and epidural analgesia  
inhalational anaesthesia

### **APPENDIX 3 - REPRESENTATIVE LIST OF PROCEDURES RELEVANT TO THE PAEDIATRIC INTENSIVE CARE SPECIALIST**

The expert trainee has acquired a diverse range of skills, which need to be maintained, reviewed and supplemented as new techniques evolve.

The expert trainee is able to carry out the commonly used procedures safely and explain the principles, indications, potential errors, contraindications and prevention of the complications. The trainee will be able to perform most of these procedures without supervision and teach and supervise safe techniques to junior doctors.

#### **Cardiopulmonary resuscitation and airway support**

expired air resuscitation

bag-and-mask ventilation

uncomplicated endotracheal intubation with means to avoid complications

- oral

- nasal

- bronchoscope-aided

management of the difficult airway

cricothyroidotomy

external chest compression

defibrillation/cardioversion

#### **Vascular access in the routine and difficult patient**

peripheral venous cannulation

central venous cannulation (subclavian, jugular, femoral, PICC)

arterial cannulation (radial, posterior tibial, dorsalis pedis and femoral)

intraosseus needle insertion

umbilical arterial and venous cannulation

#### **Ultrasound**

basic general ultrasound (e.g. vascular localisation, pleural fluid assessment)

basic cardiac ultrasound (e.g. RV dilation/dysfunction, significant LV dysfunction, pericardial effusion, volume status)

#### **Miscellaneous**

pleural drainage

pericardiocentesis

- insertion of temporary transvenous pacing wire

- insertion of oesophageal pacing wire

- setting appropriate parameters for mechanical ventilation of all patients

- fiberoptic laryngoscopy, bronchoscopy and bronchoalveolar lavage

non-invasive monitoring of blood pressure, ECG and respiratory function

measurement of cardiac output

insertion of nasogastric and nasojejunal tubes

insertion of Sengstaken-Blakemore or other balloon tamponade tube

lumbar puncture

continuous EEG monitoring

intra-abdominal pressure monitoring

neuromuscular monitoring

ICP monitoring

## NIRS

somatosensory evoked potentials

safe use of electrical equipment

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